

REMARKS

Claims 1-3 and 7-28 are pending and stand ready for further action on the merits. Claims 9-27 have been withdrawn from consideration as being drawn to non-elected subject matter. Claim 1 has been amended to recite that the deproteinized natural rubber is prepared with nonionic surfactants or a combination of nonionic surfactants and anionic surfactants. Also, new claim 28 has been added to recite specific anionic surfactants. Support for the amendment, claim 1 and new claim 28 can be found on page 8, second paragraph of the specification. No new matter has been added by way of the above-amendment.

[I] Issues Under 35 U.S.C. § 112

Claims 1-3, 7 and 8 are rejected under 35 U.S.C § 112, first paragraph containing new matter. Applicants respectfully traverse the rejection.

Specifically, the Examiner objects to line 4 of claim 1 for reciting that the deproteinized rubber can be "either or both" graft copolymerized or epoxidized.

In response, Applicants have amended claim 1 to recite that the deproteinized rubber can be either graft copolymerized or epoxidized but not both. As the Examiner has acknowledged in the

first full paragraph of page 3 of the outstanding Office Action, amended claim 1 finds adequate written description support in the present specification. Accordingly, withdrawal of the rejection is respectfully requested.

[II] Issues Under 35 U.S.C. § 103

Claims 1-3, 7 and 8 are rejected under 35 U.S.C. § 103, as being unpatentable over Yasuyuki et al. EP 584 597, taken with Kondo et al. US 4,208,490 or Burlett et al. US 5,118,546 or Hayashi et al. US 4,528,340. Applicants respectfully traverse the rejection.

[II - A] Present Invention and Its Advantages

The present invention is directed to a modified deproteinized rubber, wherein the deproteinized natural rubber is prepared in the presence of nonionic surfactants or a combination of nonionic surfactants and anionic surfactants, and wherein the deproteinized rubber is modified by either epoxidizing the deproteinized natural rubber or graft copolymerizing the deproteinized natural rubber. The use of the deproteinized natural rubber has distinct advantages over natural rubber which contains proteins.

First, the amount of protein occurring in natural rubber differs depending on the particular strain and location of the rubber tree. Therefore, deproteinizing the natural rubber gives an

intermediate composition which is essentially identical from batch to batch no matter the source. This allows for greater control of the steps for modifying the rubber.

Second, the present inventors have unexpectedly found that the proteins which naturally occur in rubber, have a deleterious effect on the chemical processes of graft copolymerizing the rubber and epoxidizing the rubber. By removing the naturally occurring proteins from the rubber, the graft ratio and graft efficiency increases and the epoxidation ratio also increase.

Third, products prepared with protein-containing rubber can elicit an allergic reaction in the person using the products. These products include surgical gloves, various catheters and anesthetic masks. By removing these naturally occurring proteins, the final products produced there from would have a reduced likelihood of causing such an allergic reaction. The advantage of using the nonionic surfactants or a combination of nonionic surfactants and anionic surfactants in the preparation of the deproteinized natural rubber aids significantly in the removal of the allergens from the natural rubber.

The above-comments have been provided to highlight the patentable distinctions between the presently claimed invention and the cited references.

[II - B] Yasuyuki et al.

Yasuyuki et al. teach a process for removing proteins from natural rubber. The advantages of the deproteinizing natural rubber include: i) elevating the green strength, ii) preventing allergic reactions, iii) lowers water absorptivity of the rubber, iv) improved crepe characteristics, vii) improved aging resistance, and viii) stabilizes the vulcanizing characteristics. (See the first paragraph of page 3).

Yasuyuki et al. fail to teach or suggest further chemically modifying the deproteinized rubber by grafting at a high efficiency or epoxidizing at a high epoxidation ratio. In addition, there is no teaching or suggestion by Yasuyuki et al. that proteins found in natural rubber will adversely affect the grafting or epoxidation of the natural rubber. Thus, significant patentable distinctions exist between the present invention and Yasuyuki et al.

[II - C] Distinctions Between the Presently Claimed Invention and Yasuyuki et al. and Kondo et al.

The Examiner, aware of the deficiencies of Yasuyuki et al. cites Kondo et al. in order to cure those deficiencies. Applicants respectfully submit that Kondo et al. do not cure the deficiencies of Yasuyuki et al.

Kondo et al. teach "a process for preparing polymer resins by polymerization of at least one ethylenic monomer onto at least one rubbery polymer optionally grafted with at least one ethylenic monomer..." see lines 20-23 of column 2. "For polymerization of the monomer component onto the rubber component, there may be employed conventional polymerization initiators and chain transfer agents." See lines 35-38 of column 3.

Applicants respectfully submit that neither Yasuyuki et al. nor Kondo et al. teach an epoxidation reaction of any substrate. M.P.E.P. 2143.03 instructs that to establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. Thus, significant patentable distinctions exist between the present invention and Yasuyuki et al. and Kondo et al.

Further, Applicants respectfully submit that Kondo et al. fail to teach or suggest: 1) the graft copolymerization of a deproteinized rubber; and 2) the improvements derived from using deproteinized rubber as the substrate.

The superior graft efficiency of the deproteinized rubber can be seen from the data in the following Table.

TABLE I^a

| | N Content ^b (%) | Graft Ratio (%) | Graft Efficiency (%) |
|--------------------------|-------------------------------|--------------------|----------------------------|
| Example 1 | 0.008 | 33.4 | 66.2 |
| Example 2 | 0.05 | 32.5 | 65.4 |
| Example 3 | 0.10 | 26.5 | 62.7 |
| Comparative Example 1 | 0.16 | 22.4 | 59.1 |
| Comparative Example 2 | 0.34 | 21.2 | 59.4 |

a: This table can be found on page 20 of the present specification.

b: The N Content is proportional to the amount of protein contained in the rubber.

As can be seen from Table I, the graft ratio and graft efficiency improve as the protein content decreases. This result cannot be expected based upon the teachings of Yasuyuki et al. as Mr. Yoshiaki MIYAMOTO avers in the Declaration under 37 C.F.R. § 1.132 (hereinafter "MIYAMOTO Declaration") (this Declaration was originally made of record as an attachment to the May 11, 2000 Amendment).

Mr. MIYAMOTO is of the opinion that the skilled artisan would not reasonably conclude that the resulting efficiency of the grafting would differ when using natural rubber versus deproteinized rubber.

Through logic, the skilled artisan would reasonably conclude that there would be little to no difference in the efficiency of the grafting process when using natural rubber versus deproteinized

rubber, since the naturally occurring proteins are not extracted from the rubber, *per se*, and are simply broken down to smaller units called polypeptides.

Yasuyuki et al. teach that the deproteinized rubber still contains the polypeptides formed during the deproteinization step (see line 34 of page 4 to line 9 of page 5). Therefore, the skilled artisan would reasonably conclude that there would be little or no improvement in the efficiency of the graft copolymerization reaction using the deproteinized rubbers, since the polypeptides from the naturally occurring proteins are still present and would impede the graft copolymerization reaction in the same manner as would the naturally occurring proteins.

In Mr. MIYAMOTO's opinion, the improved efficiency of the graft copolymerization reactions using the deproteinized rubbers is unexpectedly superior to the graft-copolymerization using natural rubber, since: 1) the polypeptides of the naturally occurring proteins are still present in the deproteinized rubber of Yasuyuki et al.; and 2) the combination of Yasuyuki et al. and Kondo et al., fail to teach or suggest that there would be such an improved efficiency.

Applicants note from the Examiner's comments at line 8 on page 4 of the Office Action, that the Examiner is relying on Kimura et al., Imai et al. and Henton et al. in finding that the inventive grafting ratio efficiency of 62.7% or more is not unexpected.

First, Applicants respectfully submit that Kimura et al. is not prior art and as such, should be relied upon by the Examiner. Second, the processes of Imai et al. and Henton et al. are far removed from the inventive process. Accordingly, the Examiner's position does not have support in these references as asserted by the Examiner.

Thus, significant patentable distinctions exist between the present invention and the combination of Yasuyuki et al. and Kondo et al.

[II - D] Distinctions Between the Presently Claimed Invention and Yasuyuki et al. and Burlett et al.

The Examiner, aware of the deficiencies of Yasuyuki et al. cites Burlett et al. in order to cure those deficiencies. Applicants respectfully submit that Burlett et al. do not cure the deficiencies of Yasuyuki et al.

Burlett et al. teach

"an elastomeric composition comprising a blend of from about 25 to about 75 percent by weight of polychloroprene and from about 75 to about 25 percent by weight of epoxidized natural rubber having a level of epoxide modification in the range of from about 15 to 85 mole percent." See the Abstract.

Applicants respectfully submit that neither Yasuyuki et al. nor Burlett et al. teach the graft copolymerization reaction of any substrate. M.P.E.P. 2143.03 (revised February 1, 2000) instructs

that to establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. Thus, significant patentable distinctions exist between the present invention and Yasuyuki et al. and Burlett et al.

Further, Applicants respectfully submit that Burlett et al. fail to teach or suggest: 1) the epoxidation of a deproteinized rubber; and 2) the improvements derived from using deproteinized rubber as the substrate.

The superior epoxidation efficiency of the deproteinized rubber can be seen from the data in the following Table.

TABLE II^a

| | N Content ^b (%) | Peracid | Epoxidation Ratio (%) | Gel Content in Toluene | Plasti -city |
|--------------|----------------------------------|----------------|-----------------------------|------------------------------|-----------------|
| Ex 4 | 0.008 | performic acid | 30.2 | 8 | 42.1 |
| Ex 5 | 0.008 | peracetic acid | 29.5 | 10 | 47.5 |
| Ex 6 | 0.10 | performic acid | 26.0 | 20 | 58.9 |
| Comp Ex 3 | 0.16 | performic acid | 24.3 | 40 | 70.2 |
| Comp Ex 4 | 0.34 | performic acid | 24.2 | 42 | 71.3 |

a: This table can be found on page 22 of the present specification.

b: The N Content is proportional to the amount of protein contained in the rubber.

As can be seen from Table II, the epoxidation ratio, gel content, and plasticity improve as the protein content decreases. This result cannot be expected based upon the teachings of Yasuyuki et al. as Mr. Yoshiaki MIYAMOTO avers in the MIYAMOTO Declaration.

Mr. MIYAMOTO is of the opinion that the skilled artisan would not reasonably conclude that the resulting efficiency of epoxidation reaction would differ when using natural rubber versus deproteinized rubber.

Through logic, the skilled artisan would reasonably conclude that there would be little to no difference in the efficiency of the epoxidation processes when using natural rubber versus deproteinized rubber, since the naturally occurring proteins are not extracted from the rubber, *per se*, and are simply broken down to smaller units called polypeptides.

As mentioned above, Yasuyuki et al. teach that the deproteinized rubber still contains the polypeptides formed during the deproteinization step (see line 34 of page 4 to line 9 of page 5). Therefore, the skilled artisan would reasonably conclude that there would be little or no improvement in the efficiency of the epoxidation reaction using the deproteinized rubbers, since the polypeptides from the naturally occurring proteins are still present and would impede the epoxidation reaction in the same manner as would the naturally occurring proteins.

In Mr. MIYAMOTO's opinion, the improved efficiency of the epoxidation reaction using the deproteinized rubbers is unexpectedly superior to the epoxidation reaction using natural rubber, since: 1) the polypeptides of the naturally occurring proteins are still present in the deproteinized rubber of Yasuyuki

et al.; and 2) the combination of Yasuyuki et al. and Burlett et al., fail to teach or suggest that there would be such an improved efficiency.

Thus, significant patentable distinctions exist between the present invention and the combination of Yasuyuki et al. and Burlett et al.

[II - E] Distinctions Between the Presently Claimed Invention and Yasuyuki et al. and Hayashi et al.

The Examiner, aware of the deficiencies of Yasuyuki et al. cites Hayashi et al. in order to cure those deficiencies. Applicants respectfully submit that Hayashi et al. do not cure the deficiencies of Yasuyuki et al.

Hayashi et al. teach

"epoxidizing a diene polymer material consisting of at least one member selected from rubber polymers which have a molecular weight of 10,000 or more and contain an 85 molar % of more 1,4-addition structure based on the entire molar amount to double bonds contained therein, and crystalline 1,2-polybutadiene polymers... and contain a 75 molar % or more 1,2-addition structure based on the entire molar amount of double bonds contained therein, for example, with a combination of a carboxylic acid and a peroxide compound, or a carboxylic peracid..." See the Abstract.

Applicants respectfully submit that neither Yasuyuki et al. nor Hayashi et al. teach the graft copolymerization reaction of any substrate. M.P.E.P. 2143.03 (revised February 1, 2000) instructs that to establish *prima facie* obviousness of a claimed invention,

all the claim limitations must be taught or suggested by the prior art. Thus, significant patentable distinctions exist between the present invention and Yasuyuki et al. and Hayashi et al.

Further, Applicants respectfully submit that Hayashi et al. fail to teach or suggest: 1) the epoxidation of a deproteinized rubber; and 2) the improvements derived from using deproteinized rubber as the substrate.

The superior epoxidation efficiency of the deproteinized rubber is not made obvious by the combination of Yasuyuki et al. and Hayashi et al. for reasons analogous to those described, *supra*, for the combination of Yasuyuki et al. and Burlett et al. which is incorporated herein by reference.

In short, Mr. MIYAMOTO holds the opinion that the improved efficiency of the epoxidation reaction using the deproteinized rubbers is unexpectedly superior to the epoxidation reaction using natural rubber, since: 1) the polypeptides of the naturally occurring proteins are still present in the deproteinized rubber of Yasuyuki et al.; and 2) the combination of Yasuyuki et al. and Hayashi et al., fail to teach or suggest that there would be such an improved efficiency.

Thus, significant patentable distinctions exist between the present invention and the combination of Yasuyuki et al. and Hayashi et al.

In conclusion, numerous and significant patentable distinctions exist between the present invention and the combination of Yasuyuki et al., with Kondo et al., Burlett et al., or Hayashi et al., and withdrawal of the rejection is respectfully requested.

Conclusion

In view of the above-amendments and comments, Applicants respectfully submit that the claims are allowable. A Notice to such effect is earnestly solicited.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Garth M. Dahlen, Ph.D. (Reg. No. 43,575) at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

Pursuant to 37 C.F.R. 1.17 and 1.136(a), the Applicants respectfully petition for a one (1) month extension of time for filing a response in connection with the present application. The required extension fee of \$110.00 is enclosed.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

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Attachments: Marked Up Version Showing Changes Made

MARKED UP VERSION SHOWING CHANGES MADE

IN THE CLAIMS:

The claims have been amended as follows:

Claim 1 (5x Amended). A modified natural rubber obtained by a modification of a deproteinized natural rubber having a nitrogen content of less than 0.10% by weight;

wherein said deproteinized natural rubber is prepared with nonionic surfactants or a combination of nonionic surfactants and anionic surfactants;

wherein said modification is either [or both] of:

A) graft copolymerizing said deproteinized natural rubber with an organic compound having an unsaturated bond selected from methacrylic acid, acrylic acid, methyl methacrylate, methyl acrylate, 2-hydroxyethyl methacrylate, acrylonitrile, vinyl acetate, styrene, acrylamide and vinylpyrrolidone, said modified natural rubber having a graft efficiency of 62.7% or more; or

B) epoxidizing said deproteinized natural rubber wherein an epoxidation rate is sufficient to produce a modified deproteinized natural rubber having an epoxidation ratio of 26.0% or more in 5 hours.

New claim 28 has been added